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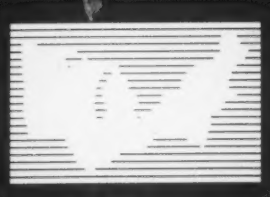
Northeast-Midwest Report



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Cleaning up Great Lakes Areas of Concern:

How Much Will It Cost?

Cate Leger
Northeast-Midwest Institute
218 D Street, S.E.
Washington, D.C. 20003
202-544-5200

September 1989

Acknowledgments

Several individuals contributed to this report. I would like to thank all of the Remedial Action Plan Coordinators, John Hartig, Glenda Daniel, Claudia Copeland, Jan Miller, and David Cowgill for providing much of the information used in this paper and reviewing the first draft. I also would like to thank David Wilke for his assistance in gathering information and Debby Cooney for editing. Finally, I would like to thank the EPA Great Lakes National Program Office for funding this work and Ralph Christensen, the EPA project director, for his helpful comments.

Although the information in this document has been funded wholly or in part by the United States Environmental Protection Agency under assistance agreement R0050081 to the Northeast-Midwest Institute, it may not necessarily reflect the views of the Agency and no official endorsement should be inferred.

Executive Summary

One of the greatest difficulties lawmakers and government officials face in continuing efforts to restore and protect Great Lakes and other coastal waters is finding adequate funding. While estimates are still preliminary, restoring Great Lakes waters so they are safe for the surrounding communities will cost billions of dollars. This paper presents current information on costs and discusses some of the most prominent methods proposed for funding.

Lawmakers, government officials, environmentalists, and others have paid a great deal of attention to Great Lakes restoration over the past two decades--with some success. Nutrient pollution, which used to deplete necessary oxygen from large areas of the lakes, has been reduced greatly. However, toxic pollution continues to threaten environmental and human health. According to Environment Canada, scientists have discovered about 300 toxic chemicals in the bodies of Great Lakes fish. States have issued consumption advisories for a variety of fish all around the region because of the high levels of toxics that have bioaccumulated in their bodies. In several areas, local wildlife are experiencing high rates of birth defects and cancers.

In the early 1970s, the International Joint Commission, a U.S.-Canadian body that oversees Great Lakes water-quality and water-quantity issues, began to identify areas where pollution was particularly bad. Currently, the Commission has listed 42 "areas of concern."

Contamination is not unique to the Great Lakes. Heavily populated and industrialized coastal areas around the country all are affected. Because of the similarity of these pollution problems, cleanup cost estimates for the Great Lakes should give other coastal communities an indication of the amount of money needed to restore their waters.

The initial estimate for cleanup at just ten areas of concern in the U.S. portion of the Great Lakes is between $2.9 billion and $3.4 billion. The areas covered are: Fox River/Green Bay and Milwaukee Harbor, Wisconsin; Waukegan Harbor, Illinois; Grand Calumet River/Indiana Harbor, Indiana; Saginaw River/Saginaw Bay, Clinton River, and Rouge River, Michigan; Black River and Ashtabula River/Harbor, Ohio; and Rochester Embayment, New York. Activities covered in this estimate include wastewater-treatment improvements, urban and rural runoff control, combined sewer-overflow elimination, contaminated-sediment dredging and treatment, research and monitoring to better quantify sources, and determination of appropriate control technologies.

The estimate probably is low because it covers remedial activities for less than half of the identified pollution sources. Government officials are unable to assign control methods or cleanup costs for many identified sources because they are not completely understood. In some cases, as with contaminated sediments, technologies for restoration cannot be recommended because they are not yet fully developed.

Future cleanup costs can be held to a minimum if existing pollution control programs are better enforced and if industries and communities take

aggressive measures to prevent generation of pollutants. In addition, research activities must provide cleanup and control methods that are cheaper than those in use today. Economic impacts also may be mitigated by spreading costs over several years and among the eight states, Ontario, plus the United States and Canadian federal governments.

Jurisdictions will have to continue to commit significant sums for many years to come. State and local governments should look for new ways to raise revenue for water-pollution control programs. At the federal level, Congress should consider revising or funding programs to make them more helpful to water-quality restoration. With revisions in program focus, the Army Corps of Engineer's navigational dredging program, the EPA's Superfund cleanup program, and Clean Water Act litigation actions could play greater roles in restoring the Great Lakes. Many Clean Water Act programs, designed to help states and EPA restore and protect water quality, need additional funding to be effective. Finally, Congress should systematically evaluate alternative funding mechanisms for cleanup, including an aquafund.

This paper is divided into four sections: an overview of the pollution problems in the Great Lakes and the legal framework for restoration; a review of cleanup costs; a discussion of possible federal funding mechanisms; and a conclusion. An appendix details the problem, estimated cleanup costs, and financing possibilities of the ten areas of concern.

1. Remedial Activity in the Great Lakes

In the past two decades the federal government and states have made significant strides in understanding and reducing pollution in the Great Lakes. Reductions in nutrient pollution have allowed large areas of the lakes to come back to life. State and federal agencies have established monitoring programs and extensive legal frameworks for water-quality protection.

The lakes continue to suffer, however, from serious problems related to nutrient pollution and, more importantly, toxic substances. Continued restrictions on fish consumption and water use throughout the Great Lakes region indicate that pervasive toxic contamination is still damaging the environment and threatening human health. In 1985, the National Academy of Sciences and the Royal Society of Canada found that residents of the Great Lakes region are exposed to more toxic substances than any other comparable group of people in North America.[1]

Years of heavy industrial and commercial use have left many of the region's harbors, rivers, and inlets with serious toxic-contamination problems. The sediments in most of these areas contain large quantities of toxic organic chemicals and heavy metals. In many cases, past contamination problems are compounded by ongoing industrial and sewage-treatment plant discharges, combined-sewer overflows, urban and agricultural runoff, and atmospheric deposition.

The Legal Framework for Great Lakes Restoration

In 1909 the United States and Canada signed the Boundary Waters Treaty in which they agreed to manage and protect shared Great Lakes water jointly. The treaty established the International Joint Commission (IJC) to oversee related water-quality and water-quantity issues. This treaty was the first in a series signed by the two countries in an effort to restore and protect the water and natural resources of the region.

To strengthen this resolve, the United States and Canada signed the Great Lakes Water Quality Agreement in 1972 committing both sides to an aggressive cleanup campaign. The focus of this agreement was the conventional pollutants that have contaminated all the lakes to a greater or lesser extent. It specified controls on phosphorus, the source of much of Lake Erie's and some of the other lakes' degraded condition. The agreement has been updated twice, most recently in 1987; both of the later agreements emphasize the need to reduce toxic inputs. The region's governors and premiers also signed the Great Lakes Toxic Substances Control Agreement in 1986 endorsing a unified, preventive approach to restoring and protecting the lakes' water quality.

The IJC began to identify areas where pollution problems were particularly bad in the early 1970s. It created a list of "areas of concern" where water quality is so degraded that uses such as fishing, swimming, or drinking are restricted. The Commission now lists 42 areas of concern; 30 of these are on the U.S. side of the lakes or are shared with Canada.

Efforts of the U.S. government to deal with these problems nationally have tended to parallel those it negotiated in the Great Lakes specific agreements. Congress enacted the Clean Water Act in 1972 which set up a regulatory framework and funding mechanism to restore water quality nationwide. One of the most important elements of this law was establishment of a construction grants program in which the federal government provided state governments with billions of dollars in matching grants to build and improve municipal wastewater-treatment systems--major sources of conventional (particularly phosphorus) pollution. The law was amended in 1977, 1981, and 1987, each time with increased emphasis on toxic and nonpoint sources of pollution.

In the 1987 reauthorization, Congress included a provision, section 304(1), requiring states to develop and implement plans for restoring water quality in "hotspots"--areas where water-quality standards still are not being met despite current regulatory efforts. The Environmental Protection Agency (EPA) published its final list of hotspots in June; several overlap with areas of concern.

While the Great Lakes Water Quality Agreement and the governors' toxics agreement have created a strong framework for Great Lakes restoration, these agreements are considered nonbinding by both state and federal governments. They did not recommend funding of levels; Congress has not yet appropriated money specifically for implementation. The position the governments have taken on enforceability, plus the lack of specific federal funds for implementation, may slow progress in solving some of the more expensive problems--particularly if solutions are not required under the Clean Water Act or other laws.

Great Lakes Areas of Concern

Areas of concern are harbors, rivers, river mouths, and connecting channels where use for fishing, swimming, navigation, or drinking has been impaired by the presence of excess pollutants. As defined in the 1987 amendments, an "'area of concern' means a geographic area that fails to meet the General or Specific Objectives of the Agreement where such failure has caused or is likely to cause impairment of beneficial use or of the area's ability to support aquatic life." (Annex 2, Section 1(a)) The 1987 amendments define "impairment of beneficial use(s)" to mean:

> a change in the chemical, physical or biological integrity of the Great Lakes System sufficient to cause any of the following: restrictions on fish and wildlife consumption; tainting of fish and wildlife flavour; degradation of fish and wildlife populations; fish tumors or other deformities; bird or animal deformities or reproduction problems; degradation of benthos; restrictions on dredging activities; eutrophication or undesirable algae; restrictions on drinking water consumption, or taste and odour problems; beach closings; degradation of aesthetics; added cost to agriculture or industry; degradation of phytoplankton and zooplankton populations; and loss of fish and wildlife habitat. (Annex 2, Section 1(c))

The International Joint Commission began to identify these areas in its 1973 biennial assessment of Great Lakes water quality. Over the years, the

list changed as states and provinces took corrective action. Figure 1 shows the location of the current 42 areas of concern.

In the past, eutrophication--a nutrient-rich condition that depletes oxygen--was the worst problem affecting the Great Lakes. An overload of phosphorus from farm runoff and poorly treated or untreated sewage fed algae that choked the lakes, killing fish and other organisms in dozens of places. Between 1971 and 1986, the U.S. federal and Great Lakes state governments spent $7.9 billion from the construction grants program to build sewage-treatment facilities.[2]

Despite the expenditures to control nutrient pollution, the dissolved oxygen content in many areas falls to a very low level in seasonal patterns. Fish kills occur every year in Milwaukee's Menominee River because of this phenomenon.[3] Nutrient-pollution problems still exist in all the lakes, especially Lakes Ontario and Erie. Lake Erie will not meet the 1990 load-reduction target at the present rate.[4]

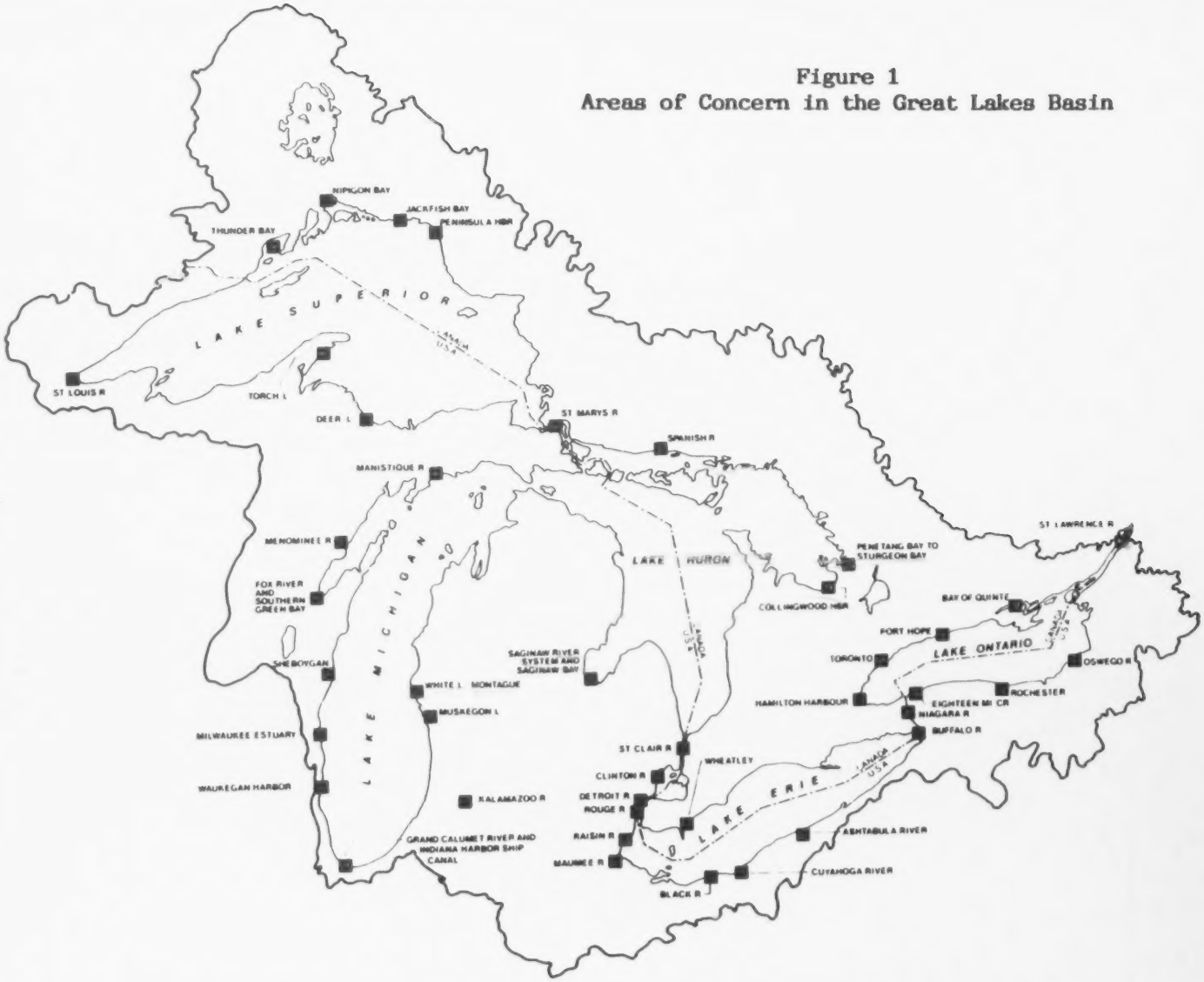
With relative improvements in nutrients-related problems, scientists were better able to see the more pervasive problem of toxic contamination. Decades of heavy industrial and commercial use turned many waterways and surrounding spots in the nation's heartland into public health hazards. According to Environment Canada, scientists have discovered about 300 toxic chemicals that have "bioaccumulated" in the bodies of Great Lakes fish. Currently, 41 of the 42 areas of concern have serious water-quality problems as a result of toxic contamination (see Table 1).

During the past 30 years, scientists have documented, at one time or another, population declines and reproductive problems in 16 top fish and wildlife predators in the Great Lakes region. Studies of bald eagles, Caspian and Forster's tern, herring gull, and lake trout indicate that parental exposure to toxic chemicals could cause poor survival rates in their offspring. While three bird species have shown a marked recovery in reproductive success and increases in population, one of these--the double-crested cormorant--exhibits a high rate of abnormalities in offspring.[5]

States and provinces have issued health advisories on fish consumption, citing PCBs and other contaminants, in 38 of the 42 areas of concern.[6] An abnormally high number of bottom-feeding fish such as bullheads and carp have lesions and skin tumors.

The IJC has identified several sources of pollution that contribute to some degree to the water-use problems in the areas of concern. These sources include resuspension of contaminants in the sediments; untreated industrial wastewater, sewage, and rainwater runoff from combined sewer overflows; rural and urban runoff; municipal and industrial discharges; deposition of airborne toxic substances; and uncontrolled leaking waste-disposal sites (see Table 2). Contaminated sediments may be the most difficult source of pollution to correct. Even after all other inputs to the lakes are arrested, chemicals and heavy metals lodged in the sediments may remain in the Great Lakes ecosystem indefinitely.

Figure 1
Areas of Concern in the Great Lakes Basin



SOURCE: 1987 Report on Great Lakes Water Quality: Report to the International Joint Commission (Windsor Ont. and Detroit, Mich.: Great Lakes Water Quality Board, 1987), p. 38.

Table 1

Summary of Water-Quality Problems Identified in Areas of Concern

(based on the most recent available data)

AREA OF CONCERN	TOXICS IN WATER	TOXICS IN SEDIMENTS	HEALTH ADVISORIES ON FISH	FISH TUMORS[1]	IMPACTED BIOLOGICAL COMMUNITY	ELEVATED BACTERIA LEVELS	ELEVATED PHOSPHORUS LEVELS	DISSOLVED OXYGEN DEPLETION
Peninsula Harbour	Yes	Yes	Yes	No data	Yes	No	Yes	No
Jackfish Bay	Yes	Yes	Yes	No data	Yes	Yes	No	Yes
Nipogon Bay	Yes	Yes	Yes	No data	Yes	Yes	No	No
Thunder Bay	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
St. Louis River/Bay	Yes	Yes	Yes	No data	Yes	No	No	No
Torch Lake	Yes	Yes	Yes	Yes	Yes	No	No	No
Deer Lake - Carp Creek/River	No	Yes	Yes	No data	Yes	No	Yes	Yes
Manistique River	Yes	Yes	Yes	No data	Yes	No	No	No
Menominee River	Yes	Yes	Yes	Yes	Yes	No	No	No
Fox River/S. Green Bay	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sheboygan Harbor	Yes	Yes	Yes	No data	Yes	No	No	No
Milwaukee Harbor	Yes	Yes	Yes	No data	Yes	Yes	Yes	Yes
Waukegan Harbor	Yes	Yes	Yes	No data	Yes	No	No	No
Grand Calumet/Indiana Harbor	Yes	Yes	Yes	No data	Yes	Yes	Yes	Yes
Kalamazoo River	Yes	Yes	Yes	No data	Yes	Yes	Yes	Yes
Muskegon Lake	No	Yes	No	No data	Yes	No	Yes	Yes
White Lake	Yes	Yes	Yes	No data	Yes	No	No	No
Saginaw River/Bay	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
Collingwood Harbour	No	Yes	Yes	No data	Yes	Yes	Yes	No
Penetang Bay to Sturgeon Bay	No	No	Yes	No data	Yes	No	Yes	No
Spanish River	No	Yes	Yes	No data	Yes	No	Yes	No

Table 1 (continued)

AREA OF CONCERN	TOXICS IN WATER	TOXICS IN SEDIMENTS	HEALTH ADVISORIES ON FISH	FISH TUMORS[1]	IMPACTED BIOLOGICAL COMMUNITY	ELEVATED BACTERIA LEVELS	ELEVATED PHOSPHORUS LEVELS	DISSOLVED OXYGEN DEPLETION
Clinton River	No	Yes	No	No data	Yes	Yes	Yes	Yes
Rouge River	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
River Raisin	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Maumee River	Yes	Yes	No	No data	Yes	Yes	Yes	Yes
Black River	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cuyahoga River	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes
Ashtabula River	Yes	Yes	Yes	No data	Yes	Yes	Yes	Yes
Wheatley Harbour	No	Yes	Yes	No data	Yes	Yes	Yes	Yes
Buffalo River	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Eighteen Mile Cr./Olcott H.	Yes	Yes	Yes	No data	Yes	No	No	No
Rochester Embayment	Yes	Yes	Yes	No data	Yes	Yes	Yes	No
Oswego River	Yes	Yes	Yes	No data	Yes	Yes	Yes	No
Bay of Quinte	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
Port Hope	Yes	Yes	Yes	No	Yes	No	Yes	Yes
Toronto Waterfront	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
Hamilton Harbour	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
St. Marys River	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
St. Clair River	Yes	Yes	Yes	No	Yes	Yes	Yes	No
Detroit River	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
Niagara River	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
St. Lawrence River	Yes	Yes	Yes	No data	Yes	Yes	Yes	No

[1] In many cases, where fish tumors have been found, further work is warranted to determine the extent of the problem and the causative factor. In other cases, fish tumors have been directly linked to contamination by polynuclear aromatic hydrocarbons.

SOURCE: 1987 Report on Great Lakes Water Quality: Report to the International Joint Commission, (Windsor, Ont. and Detroit, Mich.: Great Lakes Water Quality Board, 1987), pp. 40-41.

Remedial Action Plans for the Great Lakes

In 1985, state governments agreed to develop "remedial action plans" (RAPs) to clean up areas of concern within their borders. Local citizens, the Army Corps of Engineers (which is responsible for navigation in most of these areas), EPA, the Fish and Wildlife Service, and the National Oceanic and Atmospheric Administration agreed to cooperate, with state governments taking the lead. The goal of the plan is to restore all beneficial uses to the areas of concern.

The RAPs are expected to identify the extent of the problem and suggest measures that various state and federal agencies could take to clean up the sites. Plans are supposed to include timetables and systems to track program effectiveness.

The IJC's Water Quality Board recommended that each RAP address the following specific points:

- "identify the environmental problem, including geographic extent of the area affected, using detailed maps and surveillance information;
- identify beneficial uses that are impaired;
- describe the causes of the problems and identify all known sources of pollutants;
- provide a schedule for implementing and completing remedial measures;
- identify jurisdictions and agencies responsible for implementing and regulating remedial measures;
- describe the process for evaluating remedial program implementation and effectiveness; and
- describe surveillance and monitoring activities that will be used to track effectiveness of the program and eventually confirm that uses have been restored."[7]

The eight states and two provinces bordering on the lakes and the St. Lawrence River agreed to the IJC integrated approach to RAP development because they saw a need for coordinated regulatory and cleanup efforts. According to the 1987 Water Quality Board report:

> Previously, separate programs for regulation of municipal and industrial discharges, urban runoff, and agricultural runoff were implemented without considering overlapping responsibilities or whether the programs would be adequate to restore all beneficial uses. This new process will call upon a wide array of programs, far beyond those traditionally associated with water pollution control, including the involvement of local communities and a wide range of government agencies at all levels. All programs, agencies, and communities affecting an area of concern must work together on common goals and objectives in the remedial action plan to assure its successful implementation.[8]

Table 2.

Identified Sources of Problems for Areas of Concern[1]

(U.S. and U.S./Canadian Shared Sites Only)

Site	Contaminated Sediments	Waste Disposal Sites	Industrial Point Sources	Municipal Point Sources	Combined Sewer Overflow	Urban Runoff	Rural Runoff
Lake Superior							
St. Louis River	X	X		X			
Torch Lake	X	X					
Deer Lake	X						
Lake Michigan							
Manistique River	X	X	X	X	?		
Menominee River	X	X	?	X	X	?	?
Fox River/So. Green Bay	X	X	X	X		X	X
Sheboygan Harbor	X	X				X	X
Milwaukee Harbor	X	X	X		X	X	X
Waukegan Harbor	X						
Gr. Calumet R./Indiana H.	X	X	X	X	X	X	
Kalamazoo River	X						
Muskegon Lake		X					
White Lake		X					
Lake Huron							
Saginaw River/Saginaw Bay	X	X	X	X	X		X
Lake Erie							
Clinton River	X	X	X	X	X	X	X
Rouge River	X	X	X	X	X	X	X
Raisin River	X	X			X	X	
Maumee River	X	X	X	X	X	X	X
Black River	X	X	X	X	X	X	
Cuyahoga River	X	X	X	X	X	X	
Ashtabula River/Harbor	X	X	X			X	
Lake Ontario							
Buffalo River	X	X	X	X	X	X	
18 Mile Creek	X	X	X				
Rochester Embayment	X	X	X	X	X	X	
Oswego River	X	X	X	X	X	X	
Connecting Channels							
St. Marys River	X	X	X	X	?	X	
St. Clair River	X	X	X	X	X	X	
Detroit River	X	X	X	X	X	X	X
Niagara River	X	X	X	X	X	X	
St. Lawrence River	X	X	X			X	

1. This is preliminary. RAP coordinators warn that identified sources may change as more research is done.

SOURCES: Great Lakes Water Quality Board Report to the International Joint Commission, 1985 Report on Great Lakes Water Quality, Appendix A. Updates from: telephone interviews and written correspondences with Remedial Action Plan Coordinators between October 1988 and January 1989; Interview with Jan Miller, Chicago District Office, Army Corps of Engineers, November 1988; Interview with John Hartig, Remedial Action Plan Coordinator for the Water Quality Board, International Joint Commission, January 1989; EPA Great Lakes National Program Office.

In 1985, these governments agreed that areas of concern would be removed from the concern list when the full complement of beneficial uses was restored.

Difficulties in Implementing RAPs

Remedial action plans will prove difficult to put into effect. In several cases too few data are known to characterize the magnitude and persistence of the problems accurately, particularly biological effects, their causes or sources, and appropriate remedial measures. Assuming that these data are gathered and analyzed and RAPs written, other factors could stymie implementation.

First, the IJC does not have the authority to require that states or provinces complete plans by any set date or implement them. The IJC initially hoped that RAPs would be completed for all areas of concern by the end of 1986. In 1987, the IJC revised its goals with the expectation that 13 of the 42 RAPs would be completed by the fall of 1988. As of spring 1989, eight RAPs had been submitted. Six were returned for better definition of environmental problems. Now the IJC expects all the RAPs by 1991 (see Table 3). Delays have come, in part, from the difficulty and cost in developing the plans and lack of funds for the work.

Second, lack of sufficient information on the extent of some problems or effectiveness of cleanup technologies could put off some remedial actions for years. For example, few of the remedial action plans completed or in progress will be able to recommend actions for dealing with contaminated sediments.

Third, no consistent numerical standards exist on which to base a definition of "clean." While state environmental program administrators, regional EPA officers, and the national EPA Office of Water are making progress toward developing consistent standards, federal criteria and state standards for concentrations of pollutants in the water column, sediment, and biota are, in many cases, nonexistent or inadequate to protect human and wildlife health. Fish advisories, sediment-disposal guidelines, and water-quality criteria also are not derived in the same way or even with the same data, leading to confusion and undermining regulatory credibility.

Finally, funding to implement RAPs is not assured. Traditional environmental programs do not earmark or have adequate funds for some of the remedial activities called for in the RAPs. In addition, important federal sources of cleanup money, like construction grants for municipal wastewater treatment, are being phased out, further restricting the amount available.

Help from the Clean Water Act

Section 304(l) of the Clean Water Act requires states to submit for EPA approval in 1989 a list of hotspots and a strategy to bring affected waters into compliance within three years. If a state fails to submit an acceptable plan, EPA must develop one, in cooperation with the state.

Table 3
Progress on Developing Remedial Action Plans
(U.S. and U.S./Canadian Shared Sites Only)

Site	Jurisdiction	Progress to Date	Expected RAP Completion Date
Lake Superior			
St. Louis River	Minnesota/Wisconsin	First Draft	June 1990
Torch Lake	Michigan	RAP Completed*	
Deer Lake	Michigan	RAP Completed*	
Lake Michigan			
Manistique River	Michigan	RAP Completed*	
Menominee River	Michigan/Wisconsin	No Drafts	October 1989
Fox River/So. Green Bay	Wisconsin	RAP Completed	
Sheboygan Harbor	Wisconsin	First Draft	July 1989
Milwaukee Harbor	Wisconsin	No Drafts	October 1990
Waukegan Harbor	Illinois	No Drafts	?
Gr. Calumet River/ Indiana Harbor	Indiana	Second Draft	March 1989
Kalamazoo River	Michigan	Second Draft	?
Muskegon Lake	Michigan	RAP Completed*	
White Lake	Michigan	RAP Completed*	
Lake Huron			
Saginaw River/ Saginaw Bay	Michigan	RAP Completed	
Lake Erie			
Clinton River	Michigan	Second Draft	November 1988
Rouge River	Michigan	Second Draft	December 1988
Raisin River	Michigan	RAP Completed*	
Maumee River	Ohio	No Drafts	June 1988
Black River	Ohio	First Draft	January 1990
Cuyahoga River	Ohio	First Draft	January 1991
Ashtabula River/Harbor	Ohio	First Draft	December 1989
Lake Ontario			
Buffalo River	New York	Second Draft	1989
18 Mile Creek	New York	First Draft	?
Rochester Embayment	New York	First Draft	1990
Oswego River	New York	First Draft	1990
Connecting Channels			
St. Marys River	Ontario/Michigan	No Drafts	September 1989
St. Clair River	Ontario/Michigan	No Drafts	December 1989
Detroit River	Ontario/Michigan	No Drafts	January 1990
Niagara River	New York	First Draft	1991
St. Lawrence River	Ontario/New York	No Drafts	June 1990

* Returned to state for better definition of the environmental problems.

SOURCES: Environmental Protection Agency, Great Lakes National Program Office. Updated by Remedial Action Plan Coordinators in telephone interviews and written correspondence between September and January 1989, and by John Hartig, Remedial Action Plan Coordinator for the Water Quality Board, International Joint Commission, January 1989.

In order to meet tougher water-quality standards, states probably will have to lower allowable concentration levels of pollutants in industrial and municipal discharges. States also will have to curb discharges from a variety of sources that have received little attention in the past: leaking hazardous waste sites and landfills, toxic compounds resuspended from the sediments, overflows from combined sewage/rainwater sewers, and rural and urban runoff. In many ways the requirements of the federal hotspots law coincide with the goals laid out by the International Joint Commission for the RAPs. The legally binding nature of the federal hotspots provision may drive development and implementation of the RAPs.

2. Cleanup Cost for Areas of Concern

Cleaning up areas of concern will be a long and expensive process. States and provinces are just beginning to develop estimates. At the ten sites for which rough estimates exist--Fox River/Green Bay and Milwaukee Harbor, Wisconsin; Waukegan Harbor, Illinois; Grand Calumet River/Indiana Harbor, Indiana; Saginaw River/Saginaw Bay, Clinton River, and Rouge River, Michigan; Black River and Ashtabula River/Harbor, Ohio; and Rochester Embayment, New York--expected cleanup costs range from $1.5 million to $1.8 billion each. Total estimated costs for all ten sites range from $2.9 billion to $3.4 billion (see Table 4). The appendix contains details on the nature of the problem, estimated costs involved, and prospects for payment at each of these ten sites.

These estimates are preliminary. For most of the sites, states have not fully identified sources of contamination or appropriate remediation technology. State officials cannot quote figures for addressing certain sources of pollution because their exact effects and methods of treatment are still unknown.

Estimates probably are very conservative; officials have made cost estimates for less than half of the identified sources of pollutants. Local, state, and federal officials have identified a total of 55 sources of contamination at the ten sites reviewed; however, they have estimated cleanup costs for only 19 of the 55. On the other hand, actual costs also may be lower in the future if research breakthroughs occur. New cleanup or control technologies may be developed that are far cheaper than those currently in use. Pollution-prevention efforts, which in many places are just getting underway, also could lower control costs.

Cleanup actions for which local and state officials have estimated costs include: collection of samples to quantify the extent of the problem and to monitor progress; construction and upgrading of wastewater-treatment plants; redesign of sewer systems to reduce combined sewer overflows; use of agricultural best-management practices to reduce rural runoff; catch systems to reduce urban runoff; dredge, treatment, and disposal of contaminated sediments; and encouragement of citizen participation.

While information available at this time is too scant to estimate which sources of pollution will be most expensive to address, contaminated sediments are the most ubiquitous problem, followed closely by leaking landfills and hazardous-waste sites. While it is not clear if these sources release the most contaminants, 28 of the 30 U.S. and shared areas of concern list sediments and 27 list landfills and hazardous-waste sites as contributors. Officials reported prices for cleanup of contaminated sediments at just three areas of concern where they have reached settlements with industries totalling $116.2 million.

Table 4

Known Estimated Costs for Cleanup of Areas of Concern[1]

Site	Cost (in millions of dollars)	Time Period Covered	Activities Included
Fox River/Green Bay	68 - 640	1988 - 2000	Contaminated Sediments Research and Possible Cleanup Municipal Point Sources Control Urban Runoff Control Rural Runoff Control Additional Water Quality Studies
Milwaukee Harbor	422	1987-2000	Combined Sewer Overflows Control Urban Runoff Control Rural Runoff Control Corps Navigational Dredging
Waukegan Harbor	21	Not Available	Contaminated Sediments Cleanup
Grand Calumet R./Indiana H.	30	Not Available	Contaminated Sediments Cleanup
Saginaw River/Saginaw Bay	134 - 139	1989 - 1999	Municipal Point Sources Control Rural Runoff Control Combined Sewer Overflows Control Public Information/Education Additional Water Quality Studies
Clinton River	53	1990 - 2000	Municipal Point Source Control Rural Runoff Control Corps Navigational Dredging Contaminated Sediments Research Additional Water Quality Studies Watershed Clearinghouse
Rouge River	1,800	1988 - 2005	Combined Sewer Overflows Control Urban Runoff Control Contaminated Sediments Research Additional Water Quality Studies Public Education
Black River	1.5	Not Available	Contaminated Sediments Cleanup
Ashtabula River/Harbor	84	Not Available	Contaminated Sediments Cleanup
Rochester Embayment	241	Not Available	Combined Sewer Overflows Control
Total	2,855 - 3,432		

1. This is preliminary. Estimated costs will change as more research is done.

SOURCES: Draft Remedial Action Plans for Fox R./So. Green Bay, Saginaw R./Bay, Clinton R., and Rouge R. Telephone interviews and written correspondence between October 1988 and February 1989 with Jan Miller, Chicago District Office, Army Corps of Engineers for Grand Calumet R./Indiana H.; Julie Letterhos, Ohio EPA, RAP Coordinator for Black R. and Ashtabula R./H.; and Phil Steinfeldt, Engineer, Monroe County Department of Engineering, New York, for Rochester Embayment. Southeastern Wisconsin Regional Planning Commission, Newsletter, September-October, 1987, for Wisconsin sites. Office of Public Affairs, Region 5, EPA, Cleanup of Outboard Marine Corporation/Waukegan Harbor Site (Chicago, Ill., September 1988), for Waukegan Harbor.

Industrial point sources contribute to 20 areas of concern, and municipal point sources contribute to 18. Industries will pay for their own cleanup. State and local officials estimate that wastewater-treatment improvements at three areas of concern will cost $118 million. Researchers have identified combined sewer overflows as sources of pollutants at 16 areas of concern; cleanup at four will cost $1.06 billion. Rural runoff contributes to eight areas of concern, and urban runoff contributes to 16. Rural runoff-reduction efforts at four areas of concern and urban runoff-reduction efforts at three areas of concern will cost between $165 million and $257 million.

Sources of pollution and estimated costs to reverse their ill effects are discussed as follows:

- contaminated sediments;
- leaking hazardous waste sites and landfills;
- industrial point sources;
- municipal point sources;
- combined sewer overflow;
- urban runoff; and
- rural runoff.

Contaminated Sediments

Contaminated sediments are the most prevalent known hazard in the Great Lakes areas of concern. At 28 of the 30 U.S. and shared sites, contaminated sediments are a source of pollutants. The contamination is the result in part of years of unregulated or inadequately regulated discharges of toxic organic chemicals and heavy metals from local industries and municipalities. Contaminants also reach the sediments from rural and urban runoff and atmospheric deposition. Sediments act as a repository for toxics and heavy metals. Biota living in the sediments, animals feeding on these organisms, and any physical activity (including ship passage, storm flows, and dredging) can act to reintroduce these chemicals continually into the food chain and resuspend them in the water column.

Until EPA, scientists, and others decide on a "safe" level of pollutants in sediments and develop appropriate remediation technologies, the price for reaching that level has to remain open. EPA currently is developing sediment-quality criteria to help determine what concentrations of contaminants are harmful to the biota. EPA's Great Lakes National Program Office has set up pilot programs under the 1987 Clean Water Act to evaluate technologies to clean contaminated sediments. The Army Corps of Engineers also is evaluating appropriate cleanup technologies.

Standards must be set for dredging equipment and operation to keep cleanup activity from resuspending pollutants in the water. While sediment criteria and technology standards will narrow the wide ranges in estimates, cleanup costs still will vary a great deal depending on type of sediment, contaminants present and their levels of concentrations, and the physical characteristics of the area dredged.

According to Army Corps of Engineers estimates, cleanup could be expensive because special equipment and procedures are needed to dredge, treat, and dispose of the materials. The Corps estimates the cost for dredging

contaminated sediments and disposing of them in confined disposal facilities at approximately $25 per cubic yard. Treatment costs, on the other hand, range from $30 to $1,800 per cubic yard; incineration is highest at $1,500 to $1,800 per cubic yard.[9]

At a recent conference on contaminated sediments, Steve Garbaciak of the Army Corps of Engineers Chicago District Office estimated that in a hypothetical case, cleanup of 1 million cubic yards of contaminated sediments could cost $265 million. The cost included research and development; dredging, handling, and treating at least part of the material through chemical extraction; incineration; solidification; and final disposal of the treated byproducts.[10]

Where contaminated sediments must be removed, costs can be reduced significantly if dredging for navigation is already occurring in the area. Economies of scale make cleanup more affordable. The Army Corps maintains navigational channels in 25 of the areas of concern. It does not maintain navigation channels in Michigan's Torch Lake, Deer Lake, and Kalamazoo River; the Niagara River; or the St. Lawrence River.[11]

Sediments are a source of contamination at all ten areas of concern reviewed. Local officials, however, have estimated sediment cleanup costs at only three of these ten. The other seven RAPs include research dollars only or the numbers are only rough estimates (see Table 5). Dredging and a mix of confined disposal and incineration of contaminated sediments in Ashtabula will cost about at $83.7 million.[12] At least 200,000 cubic yards have high concentrations of PCBs. In the Black River, US Steel has agreed to dredge and landfill 50,000 cubic yards of sediments contaminated with polyaromatic hydrocarbons at a cost of $1.5 million.[13] In 1984, EPA estimated a program of dredging, landfilling, treating, and capping 1 million pounds of PCBs in Waukegan Harbor would cost $21 million.[14]

Leaking Hazardous Waste Sites and Landfills

Researchers have identified leaking hazardous waste sites and landfills as sources of toxic chemicals and heavy metals at 27 areas of concern. States and the federal government have recognized abandoned waste sites that are, may be located in, or do contaminate 27 of the areas of concern that need cleanup (see Table 6). The Great Lakes basin contains 131 sites on Superfund's National Priority List of hazardous waste dumps needing federal attention.

Nine of the ten areas reviewed list leaking waste sites and landfills as sources of pollutants. However, none of their remedial action plans included cleanup costs, which probably would be comparable to those of Superfund sites. EPA's most recent estimate for Superfund site cleanup averaged $22 million.[15]

Table 5
Estimated Costs for Cleanup of Contaminated Sediments
(in millions of dollars)

Site[1]	Estimated Cost	Activity to be Taken[2]
Fox R./So. Green Bay	1.7 - 409.7	Determine extent of the problem. Determine appropriate cleanup measures. Adopt recommended cleanup measures.
Milwaukee	20	Ongoing Corps navigational dredging.
Waukegan Harbor	21	Dredge, treat, and dispose offsite of sediments, most contaminated with PCBs. Dewater, contain, and cap the rest.
Grand Calumet R./ Indiana H.	30[3]	Dredge and dispose of 900,000 cubic yards in confined disposal facility.
Saginaw River/Bay	22 - 33[4]	Determine extent of the problem. Site and construct confined disposal facility for continued Corps navigational dredging.
Clinton River	4	Determine extent of the problem. Continue Corps navigational maintenance dredging.
Rouge River	0.7	Determine extent of the problem.
Black River	1.5	Dredge and landfill 50,000 cubic yards at US Steel site.
Ashtabula River/Harbor	83.7	$61.7 million to clean up Fields Brook Superfund site. $22 million to dredge and landfill another 500,000 cubic yards.

1. For sites not listed, no costs have been estimated for even part of the contaminated sediments remediation work.
2. For all sites except Ashtabula River/Harbor and Black River, the cost or actions listed are preliminary.
3. Eventually a total of 3 to 4 million cubic yards of contaminated sediments probably will require dredging. Depending on whether the sediments are treated, costs could range into the billions of dollars.
4. Covers only ten years.

SOURCES: Draft Remedial Action Plans for Fox R./So. Green Bay, Saginaw R./Bay, Clinton R., and Rouge R. Southeastern Wisconsin Regional Planning Commission, Newsletter, September-October 1987. Telephone interviews and written correspondence between October 1988 and February 1989 with Jan Miller, Chicago District Office, Army Corps of Engineers for Grand Calumet River/Indiana Harbor and Julie Letterhos, Ohio EPA RAP Coordinator for Black River and Ashtabula R./Harbor. Office of Public Affairs, EPA, Region 5, Cleanup of Outboard Marine Corporation/Waukegan Harbor Site (Chicago, Ill., September 1988).

Table 6
Federal or State Recognized Abandoned Hazardous Waste Sites
Associated with "Areas of Concern"[1]

Site	Has Federal Superfund Sites	Has State Superfund Sites
Lake Superior		
St. Louis River	X	X
Torch Lake	X	X
Deer Lake	X	-
Lake Michigan		
Manistique River	-	X
Menominee River	-	-
Fox River/South Green Bay	X	X
Sheboygan Harbor	X	-
Milwaukee Harbor	-	X
Waukegan Harbor	X	-
Grand Calumet R./Indiana H.	X	-
Kalamazoo River	-	X
Muskegon Lake	X	X
White Lake	X	X
Lake Huron		
Saginaw River/Saginaw Bay	-	X
Lake Erie		
Clinton River	X	X
Rouge River	X	X
Raisin River	X	X
Maumee River	-	-
Black River	X	-
Cuyahoga River	X	-
Ashtabula River/Harbor	X	-
Lake Ontario		
Buffalo River	X	X
18 Mile Creek	-	X
Rochester Embayment	-	-
Oswego River	X	-
Connecting Channels		
St. Marys River	X	X
St. Clair River	X	X
Detroit River	X	X
Niagara River	X	X
St. Lawrence River	X	-

1. This is preliminary. RAP coordinators warn that associated sites may change as areas of concern are bettor identified.

SOURCES: John H. Hartig and Patricia D. Hartig, "The Role of Environmental Litigation in Great Lakes Remedial Action Plans," Michigan Environmental Law Journal, vol. 7, no. 4, Summer 1988, pp. 2-7. RAP coordinators. Great Lakes Water Quality Board, Report to the International Joint Commission, 1987 Report on Great Lakes Water Quality, Appendix A (Toledo, Ohio, 1987). EPA, Great Lakes National Program Office.

Industrial Point Sources

Researchers have identified industrial discharges as sources of water-quality problems at 20 areas of concern. Since passage of the Clean Water Act in 1972, industries have made substantial progress in reducing the amount of pollutants they discharge. In many cases, however, industrial point-source loadings will have to be even lower to meet water-quality goals.

Companies are responsible for complying with federal and state regulations. As a result, RAP coordinators have not included expected company expenditures in cleanup cost estimates.

Municipal Point Sources

State and local governments will need to improve municipal wastewater treatment to meet cleanup goals at 18 areas of concern. States and the federal government spent about $8 billion between 1971 and 1986 on sewage-treatment plant construction and improvement in the Great Lakes states. More funds are needed, however. A 1988 EPA survey estimated that the eight states need an additional $28 billion to provide adequate wastewater-treatment systems for the present, plus population growth and migration for the next 20 years.[16]

State and federal officials list municipal wastewater-treatment plants (WWTPs) as sources of pollutants for seven of the ten areas of concern reviewed. State and local officials have developed cost estimates at three of these (see Table 7). Upgrading wastewater-treatment plants in the Saginaw River/Bay area may cost $21 million over ten years.[17] Continuing treatment-plant upgrades in the Clinton River will cost about $24 million.[18] Needed reductions in ammonia and chlorine discharges from the Green Bay metropolitan sewage district WWTP will cost about $75 million.[19]

Combined Sewer Overflows

Combined sewer overflows (CSOs) are a source of problems at 16 areas of concern. Many cities in this region have sewer systems that transport rainwater runoff and sewage in the same pipes to wastewater-treatment plants. When there is too much rainfall or when treatment plants break down, excess raw sewage and precipitation are discharged directly into the water. CSOs discharge excess nutrients, bacteria, toxic heavy metals and organic chemicals washed in from the streets or from industrial processes. EPA's Office of Water has issued new regulations that, if implemented, will help to reduce the problem.

The methods for ending CSOs include construction of storage areas to hold excess untreated water, construction of more treatment plants, and improvements of conveyance tunnels. These major public works projects can cost enormous amounts of money.

Table 7
Estimated Costs for Improvements in Municipal Point Sources
(in millions of dollars)

Site[1]	Projected Cost	Explanation of Cost
Fox River/Green Bay	75	Reduce ammonia and chlorine discharges at the Green Bay metropolitan sewage district wastewater-treatment plant.
Grand Calumet River/ Indiana Harbor	?	No estimates available.
Saginaw River/ Saginaw Bay	19	WWTP upgrades.
Clinton River	24	Improvements at 2 WWTPs.
Rouge River	0	Estimate not included in RAP.
Black River	?	No estimates available.
Rochester Embayment	?	No estimates available.

1. Only sites where municipal point sources were identified in Table 2 are included.

SOURCES: Draft Remedial Action Plans for Fox R./So. Green Bay, Saginaw R./Bay, Clinton R., Rouge R., and Grand Calumet R./Indiana H. Telephone interviews and written correspondence between October 1988 and February 1989 with Julie Letterhos, Ohio EPA RAP Coordinator for Black River and Phil Steinfeldt, Engineer, Monroe County Department of Engineering, New York.

Seven of the ten areas of concern reviewed reported combined sewer overflows as a source of contamination. State and local officials were able to report costs at four of these seven (see Table 8). Construction of retention basins and/or swirl collectors for five known projects for the Saginaw River and Bay area of concern is estimated at $31 million.[20] Halting CSOs to the Rouge River area of concern would cost $500 million in capital costs alone.[21] Stopping CSOs has cost $386 million so far in Rochester and will require $175 million over the next 20 years to complete.[22] CSO reductions to the Milwaukee Harbor will cost $358 million between 1987 and 2000.[23]

Urban and Rural Runoff

Urban runoff is listed as a source of contamination at 19 areas of concern. Urban runoff generally consists of rainwater that washes down urban and suburban streets after storms. State officials list rural runoff as a problem at eight of the U.S. and shared areas of concern. Costs for reducing

runoff vary greatly depending on the size of the area where reductions are needed.

Of the ten areas reviewed, five include rural runoff as a source of contamination, and eight include urban runoff (see Table 9). Fixing sewer connectors to control of urban runoff in the Rouge River watershed will cost approximately $13 million.[24] Wisconsin officials estimate runoff control costs for urban and rural sources together. Fox River/Green Bay runoff reductions are expected to cost between about $58 million and $150 million.[25] Milwaukee officials estimated runoff control programs for the Milwaukee Harbor watershed will cost $35 million.[26] The Michigan Department of Natural Resources expects implementation of best management practices (BMPs) for agricultural lands to reduce rural runoff in Saginaw River/Saginaw Bay to cost approximately $44 million over ten years.[27] For the Clinton River, Michigan officials enforcement of BMPs for agricultural areas will cost at least $15 million.[28]

Table 8
Estimated Costs for Improvements in Combined Sewer Overflows
(in millions of dollars)

Site[1]	Projected Cost	Explanation of Cost
Milwaukee Harbor	358	Elimination of CSOs and expansion of existing WWTP between 1987 and 2000.
Grand Calumet R./ Indiana Harbor	?	14 CSOs need to be eliminated.
Saginaw River/ Saginaw Bay	31	Construction of retention basins and swirl basins.
Clinton River	?	No estimates available.
Rouge River	500	Eliminate raw sewage discharges from 168 CSOs within 20 years.
Black River	?	No estimates available.
Rochester Embayment	175	For conveyance work.

1. Only sites where CSOs were identified as sources in Table 2 are included.

SOURCES: Southeastern Wisconsin Regional Planning Commission, Newsletter, September-October 1987. Draft Remedial Action Plans for Grand Calumet R./Indiana H., Saginaw R./Bay, Clinton R., and Rouge R. Telephone interviews and written correspondence between October 1988 and February 1989 with Julie Letterhos, Ohio EPA RAP Coordinator for Black River and Phil Steinfeldt, Engineer, Monroe County Department of Engineering, New York.

Table 9
Estimated Costs for Reducing Urban and Rural Runoff
(in millions of dollars)

Site[1]	Projected Cost	Explanation of Cost
Fox River/Green Bay	58-150	Cost varies depending on number of watersheds addressed. Includes cost for urban and rural measures.
Milwaukee Harbor	35	To improve agricultural management and construct erosion control measures betweem 1987 and 2000. Includes cost for urban and rural measures.
Grand Calumet River/ Indiana Harbor	?	No estimates available.
Saginaw River/ Saginaw Bay	44	Implementation of BMPs.
Clinton River	15	To enforce BMPs
Rouge River	13	Fix urban runoff connectors.
Black River	?	No estimates avialable.
Ashtabula River/ Harbor	?	No estimate available.
Rochester Embayment	?	No estimate available.

1. Only sites where urban and rural runoff were identified as sources are included.

SOURCES: Southeastern Wisconsin Regional Planning Commission, Newsletter, September-October 1987. Draft Remedial Action Plans for Fox R./So. Green Bay, Grand Calumet R./Indiana H., Saginaw R./Bay, Clinton R., and Rouge R.

3. Paying for Cleanup

Financing environmental protection has increasingly become a state responsibility in the last decade. Unless Congress makes new commitments of federal funds in the next few years, states and industries will have to bear a a greater share of cleanup costs. Funding for several federal Great Lakes programs declined 28 percent between fiscal 1980 and 1989 in real dollars. Wastewater-treatment construction grants declined 51 percent in real dollars during the same period.[29] Construction grants represent close to half of EPA's annual spending. At the end of 1990, the program will be phased out in favor of state revolving loan funds.

While the trend toward nonfederal spending continues, several federal programs currently fund various aspects of area of concern cleanup:

- wastewater-treatment construction grants and state revolving loan programs;
- the Army Corps of Engineers operation and maintenance dredging;
- the Superfund program; and
- the Clean Water Act nonpoint-source program.

In addition to these existing programs, environmentalists, government officials, and lawmakers have discussed several proposals for new revenue sources. This paper includes discussion of the following:

- "aquafund" and
- revenues from Clean Water Act litigation.

This is not a comprehensive list of funding possibilities. Policymakers at the local, state, and federal levels need to continue to search for creative approaches. In addition, industry and communities should continue to implement pollution-prevention programs for both toxic and nontoxic wastes released to the air and land as well as the water. Reducing the generation of pollution will lower control and cleanup costs in the future.

Below is a review of these programs. The discussions points out shortcomings in existing and proposed programs and possible revisions that would make existing programs more responsive to cleanup efforts.

Wastewater-Treatment Construction Grants and State Revolving Loan Funds

From 1971 to 1986, the U.S. and state governments spent $7.9 billion on construction and upgrading of wastewater-treatment plants in the Great Lakes region. With the Clean Water Act reauthorization in 1987, Congress began a gradual phaseout of construction grants and established state revolving loan funds in their place. Congress authorized spending of $18 billion between fiscal 1986 and fiscal 1994: $9.6 billion for construction grants and $8.4 billion to capitalize the state revolving loan funds. Assuming that the funding formula remains the same after fiscal 1990, Great Lakes states will

receive a total of $3.5 billion for construction grants and $3.1 billion for revolving loan funds (see Table 10).

In its 1988 report to Congress on state needs for wastewater-treatment grants, EPA predicted that the eight Great Lakes states would need $28.4 billion for construction and wastewater-treatment projects eligible for construction-grants funding needed to eliminate water-quality and public-health problems.

Because of the limitation on funds, most Great Lakes states will be compelled to use construction grant monies exclusively to build and improve wastewater-treatment plants and sewer overflows in areas not meeting Clean Water Act secondary-treatment standards. State and local government must pay for at least 45 percent of total fund costs. Even then, a funding shortfall will be significant.

The federal government will allocate up to $2.2 billion to Great Lakes states if they provide at least a 20-percent match to capitalize their state revolving loan funds programs. While most states will use the first and second rounds of loans to meet Clean Water Act requirements, once the loans are repaid the second time, states are free to reloan the money for nonpoint-source cleanup and estuary management-plan development as well. Some experts speculate that the definition of "nonpoint source" is broad enough that contaminated sediments could be eligible for funding under this program.

Construction grants and revolving loan funds are important sources of revenue for state and local cleanup programs in the Great Lakes. Some states plan to use these funds to finance wastewater-treatment plants and combined sewer-overflow improvements in areas of concern. However, because of the enormous costs involved and the restrictions on the use of construction grants and state revolving loan funds, local communities will have to find other sources of funds as well.

The Rouge River Planning Committee, for example, expects the river cleanup project to qualify for up to one-third of Michigan's remaining construction-grants funding, and to receive $330 million in revolving loans. Local communities will have to raise the remaining $1.3 billion and pay off loans from the revolving fund over the next 20 years. A recent U.S. General Accounting Office report on the Rouge River RAP raises serious concerns about the local community's ability to finance the cleanup without more federal help.[30]

While Congress authorized $9.6 billion for construction grants, the program has received only partial funding. The first year, funds were never allocated because the program was not yet in operation. If the program is level-funded in fiscal 1990, Congress will have appropriated only $4.76 billion of the $9.6 billion.[31] In order to meet additional municipal wastewater-treatment needs, Congress could extend the authorization period so that the full $9.6 billion earmarked can be appropriated.

Table 10
Funding Allocations and Needs
for Wastewater Treatment in the Great Lakes States
(in millions of dollars)

State	1987 Clean Water Act Authorization: Construction Grants 1986 - 1990	1987 Clean Water Act Authorization: State Revolving Loan Fund Capitalization 1989 - 1994	Funds Needed[1]
Illinois	439.1	384.2	2,958
Indiana	234.0	204.7	1,721
Michigan	417.5	365.3	3,321
Minnesota	178.5	156.1	1,106
New York	1,071.7	937.7	12,721
Ohio	546.6	478.3	3,579
Pennsylvania	384.6	336.5	1,644
Wisconsin	262.5	229.7	1,399
Total	3,534.5	3,092.5	28,449

1. These are the funds necessary to provide adequate wastewater-treatment systems for the 1988 population, plus population growth and migration for the next 20 years. The assessment includes all planning, design, and construction considered eligible for funding under the Clean Water Act.

SOURCES: The Water Quality Act of 1987, Section 206(a), Section 211, and Section 212(a); EPA, 1988 Needs Survey Report to Congress, Assessment of Needed Publicly Owned Wastewater Treatment Facilities in the United States, 430/09-89-001 (Washington, D.C., 1988), p. A-5.

Army Corps of Engineers Maintenance Dredging

The U.S. Army Corps of Engineers has the responsibility for keeping harbors and channels navigable for commercial activity. Its operations include the dredging of 25 of the 30 U.S. and U.S.-Canadian shared areas of concern. The Corps removes about 4 million cubic yards of material from these channels each year. In fiscal 1988, the Corps spent $84 million on dredging and other operations and maintenance work in the Great Lakes and adjoining waterways. The Corps dredges about 260 million cubic yards of sediment every year in locations around the country.[32]

About 50 percent of the material the Corps removes from the lakes is too contaminated for open disposal in conformance with EPA standards and must be confined. Since the late 1960s, the Corps has constructed and operated more than 30 confined-disposal facilities (CDFs) in the Great Lakes, into which it has poured nearly 50 million cubic yards of contaminated sediments.[33] The Corps works with EPA and state governments to ensure that water-quality standards of the Clean Water Act (sections 401 and 404) are met during and after the dredging process.

The Corps' ability to clean up contaminated sediments in areas of concern is limited by its mandate, funding, and technology. Federal regulations (33 CFR Parts 209, 335, 336, 337, and 338) governing maintenance, dredging, and disposal require that the Corps recommend the method that costs least, meets sound engineering practices, and complies with state and federal water-quality regulations. Corps officials expect to pay for dredging and disposal of the material to a confined disposal facility only; they could not recommend advanced treatment to alter or destroy selected sediment contaminants under the present operation and maintenance authority. In addition, Corps dredging activities are limited to the channels. Contaminated sediments outside the waterways, whose removal would improve water quality, will not be dredged by the Corps because of statutory restrictions.

Cleanup for the Grand Calumet navigation channel will cost over $50 million. According to Corps estimates, treatment of sediments could cost over $1 billion. The cost to dredge the first 900,000 cubic yards of contaminated sediments that need to be removed right now, and to construct and fill a confined disposal facility, is estimated at $30 million.[34] The price could be exponentially higher if sediments are treated as well. If lower levels of commerical navigation--caused by loss of industry or the siltation of the channel--result from cleanup activities, the Corps' ability to dredge could be affected. Maintenance of harbors that have lost commercial navigation to recreational uses have been given low priority by the administration.

By revising the Corps' mandate, Congress could increase its role in dredging for environmental purposes and in using permanent treatment for managing dredged materials. Congress also could increase funding under section 115 of the Clean Water Act to help clean up contaminated sediments. Working with EPA oversight, the Corps could play an important role in dredging and treating contaminated sediments.

Superfund

The Superfund Program was established in 1980 to deal with the problems of abandoned hazardous waste sites. The fund is financed mostly through various taxes on the chemical, petroleum, and manufacturing industries. The program is authorized at $9 billion through 1991.

EPA developed the Superfund Hazard Ranking System (HRS) to determine which of the various contaminated waste sites should be included on the National Priority List of sites eligible for federal cleanup funds. The HRS assigns numerical scores to a variety of factors, such as potential for migration of contaminants that pose risk to human communities and to the environment. EPA has identified 799 sites across the nation eligible for Superfund monies.[35] Sixteen areas of concern are Superfund sites or have Superfund sites within their borders (see Table 6).

Government officials, scientists, and environmentalists from the Great Lakes region have expressed concern that the HRS does not place adequate emphasis on human health effects from exposure to aquatic environments or on the impact of toxins on aquatic life. While several of the abandoned waste dumps around the region are listed Superfund sites, their significance as a source of surface-water contamination may be underestimated. Regional officials also are concerned that, despite growing recognition of the

importance of contaminated sediments as a source of health problems, relatively few Great Lakes sites are included on the National Priority List.

EPA is in the process of revising the HRS to fulfill a requirement in the 1986 Superfund reauthorizing amendments. The law requires the agency to revise the National Priority List (and the HRS) so that, "to the maximum extent feasible, [it] accurately assesses the relative degree of risk to human health and the environment posed by sites."[36] EPA published the proposed regulations for the revised HRS in the Federal Register in January 1989 with several improvements in this regard. However, the agency could do even more to determine risks related to aquatic environments more accurately.

In its review of the proposed regulations, the EPA Great Lakes National Program Office found several areas that could be modified.[37] Its recommendations are summarized below.

Groundwater discharges to surface water should be recognized as a method of contaminant migration. The proposed revisions to the HRS do not evaluate the potential of a waste site to contaminate surface water through the migration and discharge of groundwater it has polluted. In the Great Lakes region, many cases of leaking waste sites contaminating surface water through groundwater have been documented.

Concentrations of sediment contaminants should be considered in the analysis of surface-water quality. In addition, sediment testing should accompany each surface-water sampling. The proposed revisions to the hazard ranking system rate toxins in sediments only when they indicate a contaminant release to surface water from a land-based site under study. The system does not give adequate consideration to contaminated sediments as a distinct media that can be affected. In some cases, contaminant concentrations in the water column may not exceed water-quality criteria even though sediments may affect biota adversely.

Evaluations of the health risks to fish-eating waterfowl and wildlife should be included in standards that govern the allowable levels of toxins in water. As currently proposed, toxicity standards aim to protect only aquatic organisms; they do not consider the effects on waterfowl and wildlife that consume fish with bioaccumulated toxins. In sensitive environments in the Great Lakes, as in other areas around the country, nonaquatic organisms have suffered serious health and reproductive problems. Many of these conditions have been linked to bioaccumulation of toxic substances in their food supplies.

In addition to commercial fishing areas, contaminated recreational fishing areas should be included as an indication of an "observed release" of toxic chemicals. As currently proposed, the HRS considers closed fisheries or contaminant concentrations in fish exceeding levels set by the Food and Drug Administration--if they are attributable to a potential Superfund site--to constitute an observed release to surface water. However, it appears that the ranking system considers only commercial fisheries; it makes no specific mention of the risk presented by the consumption of fish obtained through sport fishing. This is a concern because recreational sport fishing is a major activity in the Great Lakes. Approximately 2.8 million people fish in the lakes, and most anglers eat their catch.

The hazard ranking system should evaluate bodies of water in more than one category. As currently proposed, the system rates surface water on dangers to drinking water use or fishing: the use that scores lower is "zeroed out." This approach is inappropriate. In reality, many bodies of water support mutiple uses that pose more threats to human populations. If a contaminated or potentially contaminated surface water body provides two human exposure pathways, this fact should be reflected in the evaluation.

Members of Congress and environmentalists have written to EPA in support of the Great Lakes National Program Office comments. EPA probably will issue the final rule in early 1990.

The Nonpoint Source Section of the Clean Water Act

Section 319 of the 1987 Clean Water Act amendments authorizes a $400-million, four-year program for EPA to help the states develop and implement nonpoint-source pollution-control projects. This program could be of great help to states with areas of concern that continue to have rural and urban runoff problems. The definition of a nonpoint source in this legislation may be broad enough that its funding could cover contaminated sediment cleanup.

Unfortunately, the program has received no funding to date, leaving EPA and states little leeway in program implementation. Some states, such as Wisconsin, have invested heavily in their own nonpoint-source programs. However, they can undertake only a few projects at a time because of funding limitations. Even partial funding of the federal program could leverage additional state dollars for nonpoint-source cleanup.

Aquafund

The aquafund proposal is based on the same principles and funding mechanism as Superfund. The federal government would set up a large trust fund for cleanup of contaminated sediments through taxes on water users, dischargers, and manufacturers of the chemicals found in harbor and river sediments. The fund would be used to leverage monies from responsible parties and work on sites where the responsible parties could not be found.

Convincing Congress to establish an aquafund may be very difficult in view of the budget deficit. While an aquafund would have a clearly designated revenue base, Congress may find it politically difficult to pass a bill that increases taxes. In addition, even in the Great Lakes region, where cleanup-plan development is far in advance of other parts of the country, RAP coordinators still do not know how much cleanup is necessary. Studies are needed to determine the amount of revenue that specific taxes could raise and how much money is needed.

Congress should ask the Congressional Budget Office (CBO) to analyze possible financing mechanisms for such a fund. The Office could assess the practicality of and potential revenue generated from various sources. CBO also could review the possibilities for state and local funding matches.

Clean Water Act Litigation

Local groups and state governments could increase their efforts to involve responsible parties in the cleanup process under the Clean Water Act and state Superfund programs. Industries will pay some or all of the cleanup costs in at least 11 areas of concern as a result of lawsuits and out-of-court settlements.[38]

Under the Clean Water Act, violators can be required to pay up to $25,000 per violation of a discharge permit per day. Although some states do not have a statute of limitations, most courts allow penalties within five years of violations. Guilty parties must pay the plaintiff's court costs; penalty money goes to the U.S. Treasury. Most citizen-initiated lawsuits are settled out of court, some for sizeable amounts of money. The Natural Resources Defense Council, for example, recently won a $1.5-million settlement from Bethlehem Steel Corporation. The company paid $500,000 to the state treasury and $1 million to the third-party environmental group. According to Jan Miller of the Army Corps of Engineers Chicago District Office, RAP coordinators for the Grand Calumet may involve several local industries in the cleanup process through litigation.[39]

4. Conclusion and Recommendations

Water-pollution problems are still posing serious threats to human and environmental health despite enormous resources expended on them. The preliminary information available on cost for cleanup indicates that local, state, and federal governments and industry will have to continue to commit funds for Great Lakes restoration for many years to come. While not all factors are known, cleanup costs are expected to be in the billions of dollars. Contamination is an enormous and complex problem that will not be solved overnight. While additional information on cost and research are needed, state and federal governments, almost inevitably, will have to consider allocating more funds.

Research and Pollution Prevention

In order for lawmakers to determine accurately the amount of money needed for future Great Lakes restoration, scientists and analysts will need to define the extent of pollution problems more precisely, their impact, and the cost of appropriate cleanup technologies. Future cleanup costs can be minimized if federal and state agencies adequately enforce current pollution-control programs, and communities and industries aggressively pursue source reduction.

Despite the high costs predicted at this early stage of research, scientists have only begun to understand the full extent of the damages caused by toxic contamination. They are still trying to assess the effects on the lakes of continuing industrial and municipal discharges, compared to residues from past activities. Engineers as well are still in the early stages of reviewing and developing new technologies for cleaning up and permanently disposing of contaminated sediments.

EPA needs to develop a method for determining how clean sediments must be to protect marine life and human communities. It has investigated two dozen preliminary sediment criteria, which, while far from definitive, provide at least some method for identification of unsafe sediments. The agency will have to pursue many more and finalize those already developed. It also will have to establish a method by which officials from other branches of the federal and state governments can incorporate the criteria into water-protection programs.

More restrictions on effluent discharges of pollutants would help areas of concern meet water-quality goals. While most industries and municipalities are complying with their state-established discharge limits, in many cases these limits are based on available technology, rather than water-quality standards. The hotspots provision of the Clean Water Act [section 304(1)] will force states to develop numerical water-quality-based standards for issuing discharge permits. Great Lakes states are making progress in the development of these standards.

Finally, consumers and industries could reduce pollution significantly by supporting source-reduction programs both for municipal and industrial waste. Consumers should be more sensitive to environmental problems in their

purchasing decisions. Industries should develop production processes that reduce the use and emission of toxic chemicals.

Revising and Funding Existing Programs

State and federal governments need to review new options for financing Great Lakes restoration. In addition, revising or funding several existing federal programs will help to address the pollution problems in the areas of concern.

- Congress should revise the authority of the Army Corps of Engineers to give environmental considerations more weight in decisions on whether to dredge and how to handle contaminated dredge material.

- EPA should place more emphasis on aquatic-contamination problems through the Superfund Hazard Ranking System.

- Congress should fully fund Clean Water Act programs for wastewater treatment improvements, dredging of contaminated sediments, and nonpoint-source control, as well as others, that provide guidance and help in Great Lakes restoration.

- The federal government should allocate monies obtained from Clean Water Act federal and citizen enforcement actions to water-quality restoration.

- Congress should systematically evaluate alternative funding mechanisms for cleanup.

Restoring water quality will be a long and expensive process. Without immediate actions, the problems of toxic and nutrient contamination will continue--posing additional risks to human and environmental health. Federal and state governments are making some progress toward cleanup. However, increased commitments to research and implementation of current programs are needed to restore Great Lakes areas of concern.

Appendix A. Costs and Financing for the Cleanup of Ten Areas of Concern

Fox River/Green Bay

Problem. The major problems at this site are toxic contamination, particularly in the sediments, and high levels of nutrient pollution. They have caused habitat loss, high levels of contamination in fish, reproductive problems among local wildlife populations, and closed public beaches.

Although industries and large cities discharge water containing over 100 toxic substances, PCBs present the biggest problem. Historically, pulp and paper mills were major sources of PCBs, but most have substantially reduced such discharges in recent years. Sediments contaminated years ago appear to be the major source of PCBs now entering Lake Michigan from the Fox River.

Excess nutrients continue to cause oxygen-deficiency problems by blocking sunlight from aquatic plants. RAP coordinators estimate that reversal of the problem would require a 40-percent reduction in phosphorus contamination.

Cost. Coordinators for the Fox River/Green Bay RAP have completed the public draft of the final report. The RAP outlines 16 key actions that will cost between $68 million and $640 million to implement between now and the year 2000.

Their plan includes estimates for two major projects: $58 to $150 million, depending on how many watersheds are included, to reduce nonpoint sources of pollution, and $2 to $410 million, depending on the level of remedial action, to research and clean up contaminated sediments.

The Great Bay municipal sewage district wastewater-treatment plant will have to lower ammonia and chlorine discharges at a cost of $75 million. Additional needed treatment could cost $50 million depending on the level of control required. Some of the other costs included in the total estimate are $4 to $20 million to protect wetlands and habitats; $1 to $11 million to reduce sediment resuspension; and $2 to $8 million to reduce nonpoint land-based and atmospheric sources of toxics.

Financing. The Wisconsin Department of Natural Resources has identified a variety of funding sources. The Wisconsin Nonpoint Source Pollution Abatement Program, although limited, will finance the nonpoint source work. Municipal wastewater-treatment plant work will be paid for by a variety of local, state, and federal sources. However, the other major item, cleanup of contaminated sediments, does not have a designated funding source.

Milwaukee Harbor

Problem. The major water-quality problems in the Milwaukee Harbor are excess nutrient and toxic pollution. The area is heavily populated and has been an industrial and commercial center for decades. A host of problems face the harbor as a result of this long-term activity: contaminated fish, high

levels of bacteria, reduced fish spawning habitat, and conditions that detract from recreational use.

Cost. The Southeastern Wisconsin Regional Planning Commission estimates the capital, operation, and maintenance costs of $422 million for selected remedial actions over 13 years. Some of the projections included in the estimate are $358 million for abatement of combined sewer overflows; $35 million for abatement of nonpoint sources of pollution; and $19.7 million for continued navigational dredging by the Army Corps of Engineers.

It should be noted that the study of the harbor was not designed to look at toxic-pollution problems. As a result, no actions are recommended to address them. The Commission instead encourages more study of contaminated sediments remediation and improved toxic pollution-abatement measures.

Financing. According to the Commission, public agencies will pay for 94 percent of the cost. The private sector will pay for rural nonpoint-source control land-management practices, and dredging adjacent to private port facilities. Funding for 98 percent of the cost already has been committed. However, this plan does not cover work that may be needed to reverse toxic pollution problems.

Waukegan Harbor

Problem. Waukegan Harbor is badly contaminated with PCBs. Between 1961 and 1972, Outboard Marine Corporation (OMC) released over 1 million pounds of PCBs into the harbor and adjacent land. EPA began a suit against OMC in 1978; OMC finally signed a cleanup agreement with the agency in September 1988.

Cost. In 1984 EPA agreed to a cleanup plan that would cost $21 million. At that time, EPA had planned to dredge and treat the areas with the highest concentrations of PCBs and simply cap the rest. In the 1988 agreement, OMC agreed to the same general plan. However, OMC will treat contaminated materials with slightly lower concentrations of PCBs as well. Neither EPA nor OMC has released projections for the cost of this work.

Financing. OMC will pay for all of the costs of cleanup, plus operation and maintenance of the site after cleanup.

Grand Calumet River/Indiana Harbor

Problem. The Grand Calumet River and Indiana Harbor suffer from serious toxic pollution problems. Many years of heavy industrial and municipal activity have created severe water-quality problems. The sediments are heavily polluted with PCBs, heavy metals, and many other pollutants that limit development of fish and other aquatic life and impair other potential public uses. While some sources of pollution have been brought under control, combined sewer overflows continue to contribute significantly to this problem. There are also 92 Superfund sites in the area, although the significance of their contribution is unknown.

Cost. While local authorities have not calculated costs yet, some estimates can be made for sediment cleanup based on average Corps dredging costs. According to Jan Miller of the Army Corps of Engineers, the Corps expects to dredge 3 million cubic yards of contaminated sediments over the next

30 to 40 years. To dredge and dispose of the 900,000 cubic yards that must be removed immediately, Miller predicts costs of about $30 million. The estimate includes construction and use of confined disposal facilities.

No agreement has been reached on two major issues: whether to treat sediments before disposing of them and responsibility for payment. Treating as well as disposing of these 900,000 cubic yards of sediment could cost from $50 million to $1.6 billion. Soldification is the least costly treatment method at $30 to $150 per cubic yard; incineration is the most expensive at $1,500 to $1,800 per cubic yard. Because the Corps' mandate is to maintain navigation channels, it may not have the authority to pay for and complete the treatmemt work.

Several other actions also will be needed, such as improving and enforcing water-quality standards, cleaning up area Superfund sites, eliminating the 14 combined sewer overflows in the area, and upgrading sewer treatment plants. The draft Remedial Action Plan, however, does not contain cost estimates.

Financing. The Corps is prepared to pay for the cost of dredging and disposing of sediments in the navigation channel. Beyond that, responsibility for cleanup costs is still undecided. Aside from the traditional federal, state, and local sources of funding, RAP coordinators are considering settlements with industries violating Clean Water Act permits as a potential source of revenue.

Saginaw River/Bay

Problem. Toxic organic chemicals, heavy metals and excess nutrient pollution are spoiling the Saginaw Bay and River. The sediments are contaminated with PCBs, heavy metals, DDT, PBB, and a variety of toxic chlorinated hydrocarbons. The highest concentrations of contaminants are just downstream of the two major cities, Saginaw and Bay City. Much of the toxic material, particularly the heavy metals and PCBs, was deposited in the past. However, human activities continue to add pollutants to the area of concern. In addition, over 100 state-identified hazardous waste sites are located in the basin, although little is known about their overall impact.

These pollution problems have resulted in habitat loss, a ban on consumption of local carp and catfish, restrictions on consumption of rainbow trout, brown trout, and lake trout. Fish-eating birds are suffering from reproductive problems. The incidence of cross-beaked syndrome, a birth defect, appears to be higher than normal in the Great Lakes region, and is second only to the level in the Green Bay colonies.

Cost. In its remedial action plan, the Saginaw Bay Natural Resources Steering Committee and Michigan DNR estimated costs over the next ten years of $134 to $139 million for an array of activities that will include public education, research on the extent and sources of various problems, and reduction of pollutant inputs. This estimate does not include cleaning up contaminated sediments, although their treatment is a large concern. The committee has documented the need for the following efforts: $12 million for public information/education; $19 million for wastewater-treatment plant upgrades; $31 million for combined sewer overflow reductions; $44 million for implementation of agricultural best-management practices; $22 to $33 million

for contaminated sediments sampling and research and Army Corps of Engineers navigational dredging; and $6 million for water quality and biota monitoring.

Financing. At this point, the RAP coordinators have not identified any specific funding sources, although they expect to rely on a variety of local, state, and federal programs.

Clinton River

Problem. The major problems confronting the Clinton River appear to be nutrients, toxic heavy metals, and organic contaminants. The Michigan Department of Natural Resources (DNR) has found PCBs in the water and river sediments, but it is unsure of the source or the amount entering the Great Lakes from the river. The pollutants are causing habitat loss for warmwater fish and the rest of the bottom-dwelling biota. State officials have identified 69 sites that are or may be contaminating groundwater in the county, several of which are in the Clinton River floodplain. However, the DNR does not know the extent of their contribution.

Cost. According to the draft final RAP, initial investigation and cleanup will cost $55 million over ten years. Most of the recommended actions are for additional research into sources of pollution problems. The five highest-cost items are: $3 million to continue Army Corps of Engineers navigational dredging; $24 million to complete upgrading the Mt. Clemens and Armada wastewater-treatment plants; $9 million to continue and expand studies of leaking hazardous waste sites in the area; $15 million to enforce best-management practices for agricultural runoff; and $3 million to establish a watershed-funded clearinghouse. Although combined sewer overflows will need improvements, no estimate for this work was included.

Financing. The remedial action plan identifies local, state, and federal sources for funding. The costs are low enough that no sector is expected to be seriously affected in implementing these projects. Additional remedial action, however, may be needed to clean up leaking landfills or contaminated sediments. Costs for these projects have not been considered.

Rouge River

Problem. The Rouge River bottom and its waters are badly contaminated and choking on excess nutrients. The sediments contain heavy metals and some PCBs. These pollutants and excess nutrients have caused fish spawning and biota habitat loss and bans on consumption of local carp and catfish. At least 40 miles of the river do not meet Michigan water-quality standards or Great Lakes Water Quality Agreement objectives.

Cost. Just to address combined sewer overflow and wastewater-treatment plant problems, the Rouge River Basin Committee expects a bill of $1.8 billion between now and 2005: $900 million for capital costs and another $900 million for finaning the loans for capital investments and for operation and maintenance. Combined sewer-overflow improvements will cost the most, about $500 million. Correcting improper drainage connections will cost $13 million. Although contaminated sediments are a major problem for the Rouge River, the remedial action plan committee budgeted money for research only. At this point, not enough is known about the extent of the problem or the possible cleanup solutions to predict any other expenses.

Financing. The plan indicates that expenses will be split 60 percent/40 percent between the community and state/federal sources. At this point, the committee has identified sources for only $463 million of the total $720 million it needs from the state and federal governments. The committee members believe that remedial action plan projects will qualify for $133 million in federal construction grants before they are phased out, and $330 million in loans from the state revolving loan fund. The committee still has not identified a source for the remaining $257 million in state/federal funding. The local community will have to pay the $330 million loan back, with interest, to the state revolving loan fund plus the $1.08 billion earmarked by the committee plan. Local jurisdictions are expected to finance their share through taxes and increased sewer-use fees.

Black River

Problem. The major sources of problems in the Black River are contaminated sediments, discharges from the two local wastewater-treatment plants, and combined sewer overflows. Sediments in the harbor are heavily polluted with metals, oil, grease, and oxygen-consuming materials. The Army Corps of Engineers, which dredges the harbor annually for navigation purposes, must put the dredge material in confined-disposal facilities. Further upstream, sediments are heavily contaminated with polyaromatic hydrocarbons discharged by US Steel. Evidence indicates that these substances are causing the high incidence of tumors in bottom-dwelling bullheads. A ban on consumption of fish caught locally has been in effect since 1983.

Cost. The US Steel's estimate of $1.5 million for cleanup of its polyaromatic hydrocarbons is the only dollar figure available for remedial work in the Black River area. The company has agreed to dredge 50,000 cubic yards of contaminated sediments and dispose of them in a lined sanitary landfill on the plant site.

Financing. While actual estimates are not available yet, one of the two wastewater-treatment plants for the City of Elyria has received construction grants for sewer-plant improvements.

Ashtabula River

Problem. The Ashtabula River's major cleanup need is contaminated sediments. Past industrial discharges of toxic heavy metals, chlorinated organics, and PCBs have left the Fields Brook area (which feeds into the lower Ashtabula) so contaminated that it was included on Superfund's National Priority List of sites needing federal attention. Past industrial discharges of PCBs also have contaminated the upper part of the river.

The contamination has forced Ohio's Environmental Protection Agency and the Department of Health to issue consumption advisories for fish caught in the lower part of the river and the harbor. The Army Corps of Engineers stopped dredging the upper channel in 1962 because of concerns about the contamination; 200,000 cubic yards of the sediment had such high concentrations of PCBs that it was declared toxic under the Toxic Substance Control Act. Another 300,000 cubic yards is highly polluted and must be disposed in a confined area. The channel is now getting so shallow that even recreational vehicles are having problems getting through.

Cost. Incineration of the worst contaminated sediments in Fields Brook and landfilling of the rest probably will cost $61.7 million. In 1987, the Buffalo Army Corps of Engineers regional office designed a cleanup plan with advice from all parties for dredging the harbor and river channel at a cost of $22 million. The Corps plans to dispose of all 500,000 cubic yards of dredged material in compliance with Toxic Substance Control Act regulations because nontoxic material could not be separated.

Financing. Superfund will pay for the Fields Brook cleanup. Funding mechanisms for the Corps' work has not been agreed to yet. According to Julie Letterhos, coordinator of the Ohio EPA remedial action plan, the projected $22 million substantially exceeds the budget allowed to the Corps' Buffalo office. It requested more funds from the Washington Office of the Chief of Engineers. It is reluctant to approve the project due to the handling of contaminated materials and the fact that most of the benefit would go to recreational navigation. Letterhos states that U.S. EPA maintains that it has no provisions for cost-sharing to facilitate this project.

Rochester Embayment

Problem. The major problems confronting the Rochester Embayment are toxic substances in its waters, sediments, and excess nutrient pollutants. The Rochester harbor and the Genesee River are moderately to heavily contaminated with arsenic, nickel, zinc and cyanide as a result of discharges from area industries. Impaired uses include fish consumption, habitat loss, and aesthetics.

Cost. Combined sewer overflow work is 60 percent completed. The local engineering department estimates expenses of $241 million to complete the work: $175 million for conveyance tunnels and $66 million for surface work. Officials have not calculated costs for other phases of cleanup.

Financing. According to Phil Steinfeldt of the Monroe County Department of Engineering, the community can obtain only $70 million in construction grants for the total project. The rest will be funded locally.

Appendix B. Remedial Action Plan Coordinators

1.	PENINSULA HARBOUR	Patricia Inch	OMOE, Thunder Bay	(807) 475-1315
2.	JACKFISH BAY	Jim Murphy	OMOE, Thunder Bay	(807) 475-1315
3.	NIPIGON BAY	Jake VanderWal	OMOE, Thunder Bay	(807) 475-1215
4.	THUNDER BAY	Jake VanderWal	OMOE, Thunder Bay	(807) 475-1215
5.	ST. LOUIS RIVER	Marvin Hora	MWPCA, Roseville	(612) 296-7215
6.	TORCH LAKE	Elwin Evans	MDNR, Lansing	(517) 335-4182
7.	DEER LAKE-CARP CREEK-CARP RIVER	Elwin Evans	MDNR, Lansing	(517) 335-4182
8.	MANISTIQUE RIVER	Brenda Sayles	MDNR, Lansing	(517) 335-4198
9.	MENOMINEE RIVER	Rick Lundgren Steve Skavroneck	MDNR, Lansing WDNR, Madison	(517) 335-3313 (608) 267-9352
10.	FOX RIVER/ GREEN BAY	Lynn Persson	WDNR, Madison	(608) 266-9267
11.	SHEBOYGAN HARBOR	Steve Skavroneck	WDNR, Madison	(608) 267-9352
12.	MILWAUKEE HARBOR	Steve Skavroneck	WDNR, Madison	(608) 267-9352
13.	WAUKEGAN HARBOR	Jim Park	IL EPA, Springfield	(217) 782-3362
14.	GRAND CALUMET/ INDIANA HARBOR	Robert Hilton	IN DEM, Indianapolis	(317) 232-8568
15.	KALAMAZOO RIVER	William Creal	MDNR, Lansing	(517) 335-4181
16.	MUSKEGON RIVER	John Wuycheck	MDNR, Lansing	(517) 335-4195
17.	WHITE LAKE	John Wuycheck	MDNR, Lansing	(517) 335-4195
18.	SAGINAW RIVER/ SAGINAW BAY	Greg Coudy	MDNR, Lansing	(517) 335-3310
19.	COLLINGWOOD HARBOUR	Katharine Simpson	OMOE, Toronto	(416) 323-4948
20.	PENETANG BAY TO STURGEON BAY	Keith Sherman	OMOE, Toronto	(416) 323-4956
21.	SPANISH RIVER	Art Roy	OMOE, Sudbury	(705) 675-4501
22.	CLINTON RIVER	Dave Kenaga	MDNR, Lansing	(517) 335-4314
23.	ROUGE RIVER	Jim Bredin	MDNR, Lansing	(517) 335-4140
24.	RIVER RAISIN	Scott Cornelius	MDNR, Lansing	(517) 335-4200
25.	MAUMEE RIVER	Julie Letterhos	OH EPA, Columbus	(614) 466-7029
26.	BLACK RIVER	Julie Letterhos	OH EPA, Columbus	(614) 466-7029
27.	CUYAHOGA RIVER	Julie Letterhos	OH EPA, Columbus	(614) 466-7029
28.	ASHTABULA RIVER	Julie Letterhos	OH EPA, Columbus	(614) 466-7029
29.	WHEATLEY HARBOUR	Doug Huber	OMOE, London	(519) 661-2200
30.	BUFFALO RIVER	Robert Collin	NYSDEC, Albany	(518) 457-0669
31.	EIGHTEEN MILE CREEK	Robert Collin	NYSDEC, Albany	(518) 457-0669
32.	ROCHESTER EMBAYMENT	Robert Collin	NYSDEC, Albany	(518) 457-0669
33.	OSWEGO RIVER	Robert Collin	NYSDEC, Albany	(518) 457-0669
34.	BAY OF QUINTE	Murray German	OMOE, Kingston	(613) 549-4000
35.	PORT HOPE	Robert Krauel	Env Canada	(416) 973-5858
36.	TORONTO WATERFRONT	Marta Griffiths	OMOE, Toronto	(416) 323-4955
37.	HAMILTON HARBOUR	Keith Rodgers	CCIW, Burlington	(416) 336-4888
38.	ST. MARYS RIVER	Wayne Wager Diana Klemans	OMOE, Sarnia MDNR, Lansing	(519) 336-4030 (517) 373-2758
39.	ST. CLAIR RIVER	Dean Edwardson Diana Klemans	OMOE, Sarnia MDNR, Lansing	(519) 336-4030 (517) 373-2758
40.	DETROIT RIVER	Dean Edwardson Dave Kenaga	OMOE, Sarnia MDNR, Lansing	(519) 336-4030 (517) 335-4314
41.	NIAGARA RIVER	Jaak Viirland Robert Collin	OMOE, Hamilton NYSDEC, Albany	(416) 521-7720 (518) 457-0669
42.	ST. LAWRENCE RIVER	John Marsden Robert Collin	Env Canada NYSDEC, Albany	(416) 973-1062 (518) 457-0669

JURISDICTION ADDRESSES FOR RAP COORDINATORS

CCIW
P.O. Box 5050
Burlington, ON7th Fl.
L7R 4A6

Environment Canada
25 St. Clair Ave. E.
Springfield, IL 62706
Toronto, ON M4T 1M2

Illinois EPA
2200 Churchill Rd.

Indiana DEM
105 S. Meridian
Indianapolis, IN 46225

MWPCA
1935 West County Rd. B2
Roseville, MN 55113

Michigan DNR-SWQD
P.O. Box 30028
Lansing, MI 48909

NYSDEC
50 Wolf Rd. Rm. 201
Albany, NY 12233

Ohio EPA
P.O. Box 1049
Columbus, OH 43266-0149

Ontario MOE
P.O. Box 2112
Hamilton, ON L8N 3Z9

Ontario MOE
P.O. Box 820
Kingston, ON K7L 4X6

Ontario MOE
975 Adelaide St. S.
London, ON N6E 1V3

Ontario MOE
265 Front St. N. Ste. 109
Sarnia, ON N7T 7X1

Ontario MOE
199 Larch St. 11th Fl.
Sudbury, ON P3E 5P9

Ontario MOE
P.O. Box 5000
Thunder Bay, ON P7C 5G8

Ontario MOE
135 St. Clair Ave. W.
Toronto, ON M4V 1P5

Wisconsin DNR
P.O. Box 7921
Madison, WI 53707

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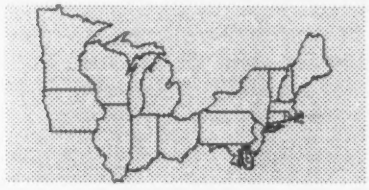
Northeast-Midwest Institute

The Center for Regional Policy



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